



Course unit English denomination	Kalman Filter and State Space Models
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SS	STAT-02/A
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Teacher in charge (if defined)	Siem Jan Koopman
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Teaching Hours	9
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Number of ECTS credits allocated	1
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Course period	06/2027-07/2027
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Course delivery method	<input checked="" type="checkbox"/> In presence <input type="checkbox"/> Remotely <input type="checkbox"/> Blended
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Language of instruction	English
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Mandatory attendance	<input checked="" type="checkbox"/> Yes (100% minimum of presence, apart from exceptional absences that must be justify in advance) <input type="checkbox"/> No
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Course unit contents	<ul style="list-style-type: none">- Introduction- Time Series Models<ul style="list-style-type: none">- Local Level Model- Unobserved Component Time Series Models- Multivariate Extension, incl. Dynamic Factor Models- State Space Methods<ul style="list-style-type: none">- Kalman Filter- Observation Weights- Log likelihood Evaluation and Parameter Estimation- Diagnostic Checking- Smoothing- Missing Values and Forecasting- Usage of Principal Components- Nonlinear non-Gaussian Extensions<ul style="list-style-type: none">- Extended Kalman filter- Dynamic models for discrete data- Stochastic Volatility- Conclusion and Discussion
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Learning goals	Students will understand the principles of state space models and Kalman Filters, including the necessary mathematical foundations. They will learn to model dynamic systems, design and implement standard and extended Kalman Filters, but also particle filters, and evaluate their performance through diagnostic error analysis. The course will cover real-world applications and software development for implementation.
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Teaching methods	<ul style="list-style-type: none">• Lectures• Laboratories
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Course on transversal,
interdisciplinary,
transdisciplinary skills

- Yes
 No

Available for PhD
students from other
courses

- Yes
 No

Students from other PhD courses may be admitted subject to CV evaluation and until the maximum number of students has been reached

Prerequisites

An intermediate level of statistical theory, time series models and matrix algebra are required for this course.

Examination methods
(in applicable)

None

Suggested readings

- Course material available from the instructor
- Commandeur, J. J. F. & Koopman, S. J. (2007). An Introduction to State Space Time Series Analysis. Oxford University Press
- Durbin, J. & Koopman, S. J. (2012). Time Series Analysis by State Space Methods. Oxford University Press

Additional information
